Remarks

Claims 1, 8-15, 19, 22-28 and 30 remain in the application. Applicant notes with appreciation Examiner Edmondson's allowance of claim 30.

Claims 13-15 and 27 were objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. Applicant notes with appreciation that claims 13-15 and 27 are allowable. New claims 59-61 have been added.

In the Office Action, claims 1, 8-12, 19, 22-26 and 28 were rejected on the basis of 35 USC 103(a), as follows:

> Claims 1, 8-12, 19, 22-26 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fukuda et al. (WO 01/85382 Al) in view of Chakrabarti et al. (US 2006/0083654 Al) and Park (USPN 4589932).

According to the U.S. Patent Office,

> Fukuda teaches a method of friction stir welding of precipitation hardened (pre weld aging) Al alloy by aging before and after welding (abstract). The post-weld aging occurs at about 374 F (190 C) for about 1.5 to 10 hours (paragraphs 10, 12 and 16).1xxx and 6xxx series Al are preferably used however the alloys are not further disclosed. Neither are the time and tempering schedules further disclosed.
>
> Chakrabarti teaches aging of Al alloys including but not limited to series 7xxx (paragraph 2) such as 7055 (paragraph 7), 7050 and 7150 (paragraph 12) using known tempering schedules which include but are not limited to T6, T73, T74, T76 (paragraphs 7, 9, 20, 82 and 83) which take place at typical temperatures of 150 F to 325 F for a typical period of hours (paragraphs 18-20). The members are friction stir welded (paragraph 124).
>
> Park teaches aging of Al alloys in series 7xxx such as 7475 (col 9 lines 30-34) using known tempering schedules which include but are not limited to T8 which take place at typical temperatures of 220 F to 350 F for a typical period of hours (figures 2, 3, coil lines 25-61, col 6 lines 56-67, col 13 line 45—cal 14 line 9 and Table VII). The members are welded (col 14 lines 63-68).
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to use known tempering schedules for 7xxx series Al to maintain the desired strength, stiffness and ductility in both the weld zone and the heat-affected region in a simple and predictable manner. Al

alloys in the 6xxx and 7xxx series are well known, cost-effective aircraft alloys.

The rejection is respectfully traversed.

Applicant's invention includes the steps of providing a 7xxx series alloy, aging to ***precipitate GP zones and coherent η' precipitate***, friction stir welding, and aging after welding and then aging to reprecipitate strengthening GP zones and coherent η' precipitates dissolved in the weld zone during welding, the second aging step being a T7X aging step.

Applicant's claim 1 is set forth below for convenience.

> 1. A method of welding age-hardenable aluminum alloy to improve strength properties in a heat affected zone and a weld zone, the method comprising the steps of:
>
> (a) providing precipitation hardenable 7000 series aluminum alloy members to be welded;
>
> (b) subjecting said members to a first aging step for times and temperatures to generate GP zones and coherent η' strengthening precipitates to provide aged members;
>
> (c) friction stir welding said aged members to provide a welded assembly having a weld zone; and
>
> (d) subjecting said welded assembly to a second aging step to reprecipitate strengthening GP zones and coherent η' precipitates dissolved in the weld zone during the welding step, the second aging step being a T7X aging step.

The Office Action states that Fukuda teaches a method of friction stir welding of precipitation ***hardened*** aluminum alloys by aging before and after welding, and cites the abstract of WO 01/85382A1 (Fukuda), which is as follows:

> With a view to making it unnecessary to employ a filler material lowering the conductivity and keeping satisfactory conductivity, strength and corrosion-resistance after the jointing, an aluminum alloy member of a conductivity of 55% or more is frictionally agitated and jointed to a material of the same or different kind and assembled into a conductive structure of a desired shape. As the aluminum alloy member of the conductivity of 55%

> or more, a 1000-class aluminum alloy is used for a portion requiring no strength, and a ***precipitation hardened*** aluminum alloy is used for a portion requiring a strength. When the ***precipitation hardened*** aluminum alloy is frictionally agitated and jointed, it is preferable to give the strength by aging after the frictional agitation and jointing. It is also preferable that the temperature in the range of 400 to 300°C is lowered at a rate of 20°/min in the temperature lowering process after the frictional agitation and jointing.

The rejection is respectfully traversed. It is submitted that Applicant's claim 1 is patentable over Fukuda for a first reason. That is, Fukuda is ***silent*** with respect to 7000 series aluminum alloys, as required in Applicant's claims. Thus, because Fukuda is ***silent*** with respect to joining 7000 series aluminum alloys, Fukuda cannot make Applicant's invention obvious taken singly or combined. Accordingly, Applicant's invention is patentable over Fukuda.

It is respectfully submitted that Applicant's invention is patentable over Fukuda for a second reason. That is, Applicant's claim 1(b) requires a first aging step that generates ***GP zones*** and ***coherent η'*** strengthening precipitates. Fukuda is ***silent*** and ***does not disclose*** a first aging step which generates GP zones and coherent η' precipitates. This step in Applicant's invention is explained in Applicant's specification at ¶0038 as follows:

> **[0038]** Prior to welding, the alloy members are subjected to a first treatment, phase or step to condition the metal for welding. As noted, the alloy members to be welded are subject to an artificial aging treatment for a time and temperature to produce or generate strengthening precipitates such as GP zones and coherent η' precipitate ($MgZn_2$). GP zones are clusters of atoms, for example, copper, magnesium and zinc in the 7xxx series. The greater the density of GP zones and η' coherent precipitates, the less likely the alloy in the heat affected zone will be overaged during the welding process.

Fukuda is ***silent*** with respect to GP zones or coherent η' precipitates, and thus, Applicant's invention is patentable thereover.

GP zones and incoherent η' precipitates are an important feature of Applicant's invention, as explained at ¶0039 of Applicant's specification, as follows:

[0039] The first aging or pre-weld treatment for AlZnMgCu alloys includes subjecting the members to be welded to a temperature range of 100° to 300°F, preferably 200° to 300°F for a time period in the range of 0.25 to 24 hours. The object of this treatment is to obtain a large density of precipitates having very small size. As noted, such precipitates include the GP zones and the η' phases. A preferred size of GP zone is in the range of 2 to 3.5 nm and a preferred density of $4 \times 10^{18} - 5 \times 10^{18}$ zones per cm^3 Thus, the first aging step is designed to create a large population of GP zones and coherent η' precipitates, which in turn minimizes or prevents overaging occurring in the heat affected zone. For example, if incubation time for incoherent η' precipitates to form is greater than the time the heat affected zone is exposed to temperatures above 315°F then overaging in the heat affected zone is prevented or significantly reduced. Incoherent η' precipitates are larger in size than coherent η' precipitates and have lost the coherency with the matrix.

Clearly, Fukuda is ***silent*** with respect to these features.

Not only is Fukuda ***silent*** with respect to GP zones and coherent η' precipitates, but it is respectfully submitted that the principal metal that Fukuda is jointing AA1000 which is ***incapable*** of forming coherent η' precipitates because of its high purity. That is, there are no elements present in the AA1000 alloy to form precipitates. Thus, it would be futile to subject it to pre-weld aging step. Thus, since the AA1000 aluminum alloy does not benefit from a pre-weld aging step, it is submitted that Fukuda cannot teach such step. Therefore, Applicant's invention is patentable over Fukuda.

It is respectfully noted that Applicant's invention requires "precipitation hardenable 7000 series aluminum alloy members to be welded" (see claim 1(a)). By distinction, Fukuda discloses jointing a non-heat treatable or non-precipitation hardenable alloy to an age hardenable alloy.

It is submitted that Applicant's invention is patentable over Fukuda for another reason. That is, the second thermal treatment or precipitation hardening treatment would have no effect on Fukuda's AA1000 alloy. Therefore, the weld zone in Fukuda would not become stronger because of the inherent weakness of 1000 series alloy. Thus, Applicant's invention is patentable over Fukuda because Fukuda ***does not and cannot***

disclose "improved strength properties" in a "heat affected zone and a weld zone", as required by Applicant's invention. The benefits of strengthening properties in the weld zone of Applicant's invention are clearly demonstrated in Applicant's Example 1, where TS went from 66.8 KSI to 73.6 KSI, and YS went from 55.7 KSI to 63.8 KSI.

It is respectfully submitted that Applicant's invention is patentable over Fukuda for yet another reason. That is, there is no ***teaching*** in Fukuda of a first aging step (see claim 1(b)). The only reference to precipitation hardened alloys is the abstract, which is a translation from Japanese. Contrary to the U.S. Patent Office, Fukuda is ***silent*** and does not disclose "aging before" welding. For example, Fukuda's specification, Examples and claims are devoid of any reference to "aging before" welding. Fukuda refers to "precipitation hardening type aluminum alloys" many times, and it is submitted that this was intended in the translation of the abstract of Fukuda. In fact, publication of Fukuda in "patent abstracts of Japan" uses the language "precipitation hardening type aluminum alloys" throughout and indicates that the "strength is preferably imparted thereto by aging treatment ***after*** friction welding" (see Fukuda's paragraph labeled "SOLUTION"; claims 3 and 4; ¶ [0004]; ¶ [0008]; and ¶ [0010].

It should be noted that Applicant's invention is patentable over Fukuda for yet another reason. That is, Fukuda is not concerned with and is ***silent*** with respect to ***strength*** of the weld zone or heat affected zone. But rather, Fukuda is concerned with the ***electrical conductivity*** of the weld zone. Thus, because Fukuda is ***silent*** with respect to strength of the weld zone, there can be no teaching or even suggestion of Applicant's invention.

In the Japanese abstracts of Japan under the paragraph labeled "Problem to be solved" and "solution", which is almost the same as the "abstract", uses the term "precipitation hardening type aluminum alloys. It is respectfully suggested that what is meant by the term "hardened" in the "abstract" is that the alloys ***can be hardened*** because there is no teaching of hardening by disclosure of times and temperature before welding in Fukuda's specification, the examples or claims.

Even if Fukuda is taken in view of Chakrabarti '654 and Park '932, the combination does not make Applicant's invention obvious. That is, Chakrabarti and Park do not supply the features missing in Fukuda.

Thus, Applicant's invention is patentable over this combination. That is Chakrabarti is concerned with aluminum alloy products having improved property combinations and method for artificially aging the same. Chakrabarti, in the abstract, discloses as follows:

> Aluminum alloy products, such as plate, forgings and extrusions, suitable for use in making aerospace structural components like integral wing spars, ribs and webs, comprises about: 6 to 10 wt. % Zn; 1.2 to 1.9 wt. % Mg; 1.2 to 2.2 wt. % Cu, with $Mg \leq (Cu+0.3)$; and 0.05 to 0.4 wt. % Zr, the balance Al, incidental elements and impurities. Preferably, the alloy contains about 6.9 to 8.5 wt. % Zn; 1.2 to 1.7 wt. % Mg; 1.3 to 2 wt. % Cu. This alloy provides improved combinations of strength and fracture toughness in thick gauges. When artificially aged per the three stage method of preferred embodiments, this alloy also achieves superior SCC performance, including under seacoast conditions.

However, there is no reference in Chakrabarti concerning weld zones or heat affected zones, which is the primary concern of Applicant's invention.

The Court of Appeals for the Federal Circuit (CAFC) has continued to maintain the requirement of its predecessor court, the CCPA, that there be a ***suggestion of desirability*** of combinations and/or ***modifications in references*** being cited. In C. Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick, 221 USPQ 481 (Fed. Cir., 1984), at page 488, the Court stated:

> The claimed invention must be considered as a ***whole***, and the question is whether there is something in the ***prior art as a whole*** to suggest the desirability, and thus the obviousness, of making the combination.
>
> Nothing in the references ***alone or together*** suggests the claimed invention as a solution to the problem of crushing rigidly massive scrap. (Emphasis added.)

The Court then cited, with approval, In re Imperato, 179 USPQ 730, and In re Sernaker, 217 USPQ 1.

The CCPA and more recently the CAFC have recited the requirement of a suggestion for combining references in a number of cases. In the case of In re Imperato, the CCPA stated, at page 732:

> With regard to the principle rejection, we agree that combining the teaching of Schaefer with that of Johnson or Amberg would give the beneficial result observed by appellant. However, the mere fact that these disclosures ***can*** be combined does not make the combination obvious unless the art also contains something to ***suggest*** the desirability of the combination. (Emphasis in original.)

In Applicant's case, the main reference, Fukuda, is concerned with ***electrical conductivity*** in the weld zone, and Applicant's invention is ***not*** concerned with electrical conductivity in the weld zone. The In re Imperato case was cited with approval by the District of Columbia District Court in Berghauser v. Dann, Commissioner of Patents, 204 USPQ 393 at page 396.

The CAFC, in ACS Hospital Systems, Inc. v. Montefiore Hospital, 221 USPQ 929 stated, at page 933:

> Obviousness cannot be established by combining the teachings of the prior art to produce the claimed invention, ***absent some teaching or suggestion supporting the combination***. Under section 103, teachings of references can be combined ***only*** if there is some ***suggestion or incentive*** to do so. The prior art of record fails to provide any such suggestion or incentive. (Emphasis in original)

It is respectfully submitted that instead of supporting a suggestion, these two references are concerned with different welding problems. Thus, there can be no suggestion. Thus, for this additional reason, Applicant's invention is patentable over this combination.

With respect to Park, the only reference to welding is col. 14, lines 63-66, where it is indicated as follows:

> The improved products provide for many improved structural members including shipping pallets and containers made by shaping sheet or extrusion members and riveting or welding the assemblies together.

Clearly, this is not a teaching of Applicant's invention. That is, Park does not supply the steps missing in Fukuda. It is respectfully submitted that Applicant's claims are patentable over the combination of Fukuda and Park. It is further submitted that Applicant's invention is patentable over the combination of Fukuda and Park for a further reason. That is, there is no suggestion to make the combination rejection.

Claims 8-12, 19, 22-26 and 28 are patentable over Fukuda in view of Chakrabarti and Park for the reasons set forth above.

Claim 9 is patentable for the additional reason that it requires aging to a T76 temper.

Claim 10 is patentable for the additional reason that it requires aging to a T73 temper.

Claim 11 is patentable for the additional reason that it requires aging to a T74 temper.

Claim 12 is patentable for the additional reason that it requires aging to a T77 temper.

Claim 19 is patentable for the additional reason that it requires an alloy selected from the group consisting of AA7075, AA7050, AA7150, AA7055, AA7068, AA7249, AA7349 and AA7449.

Claim 22 is patentable for the additional reason that it requires a 7xxx alloy with post aging to provide T6, T73, T74, T76 and T77 tempers.

Claims 24-26 are patentable for the additional reason that they require specific aging treatment.

Claim 28 is patentable for the additional reason that it requires an alloy selected from the group consisting of AA7075, AA7050, AA7150, AA7055, AA7068, AA7249, AA7349 and AA7449.

New claim 59 is claim 13 written in independent form, which is allowable.

Claims 60 and 61 are dependent on claim 59, and therefore, are allowable.

In view of the above remarks, it will be noted that a sincere attempt has

been made to place this application in condition for allowance. Therefore, reexamination and reconsideration are requested and allowance solicited at an early date.

Respectfully submitted,

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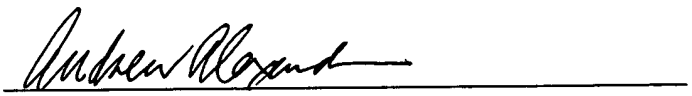

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